sible for the abuse. The law itself provides them with two very important safeguards. In the first place, two disinterested viewers are appointed by the board of commissioners to pass upon the question of public utility. Secondly, if the viewers pass it as a public utility, any ten dissatisfied taxpayers of the township may petition for a hearing before the state tax board, where both sides of the controversy will have a right to appear and be heard. If the taxpayers themselves remain awake, as they evidently have during the past two or three years, there is very little probability of their being forced to pay for the construction of roads that are not for the best interests of the general public.

The law has been in force for more than a quarter of a century, and since most, if not all, of the townships of the state have availed themselves of its provisions for a speedy and inexpensive method of road building, and since those communities that still are so unfortunate as to have no improved roads have been helping to pay for the construction and maintenance of roads in other parts of their townships, both by direct and indirect taxation, it seems to me to be a breach of equity and common justice to repeal the law at this time and compel those still in need of improved roads to make use of the more hazardous and inexpensive election method.

THE VICISSITUDES OF AN ENGINEER'S WORK

By A. W. Karstetter, Dearborn County Surveyor

In the section where I practice, an engineer's work is composed largely of construction of roads, streets, and bridges. We have very little tile or open ditch work, only three or four small jobs of this nature having been done within the last fifteen years. Unquestionably, in certain parts of the county, the productivity of the soil would be materially enhanced if drainage ditches were constructed, but the farmers have never organized for the purpose.

The engineer who practices his profession outside of the large centers of population is compelled to know something at least about a great many branches of the profession. In the small cities and towns we are called upon to handle street paving, curb and gutter construction, an occasional storm water or sanitary sewer, sidewalks, subdivisions, cemeteries, property lines, layouts of premises for attorneys in court actions, assessment rolls, abstracts of title, and a multitude of other matters.

To this should be added farm land surveys. I understand that in a few Indiana counties this type of work takes no small part of the surveyor's time. Fortunately for me, this happens very infrequently in my county. I say "fortunately" for the

reason that of all the different classes of engineering work with which I have been connected, land surveying is least to my liking. Especially does this apply to cases where adjoining farm owners dispute the location of their dividing line; for no matter how carefully the surveyor may do his work of establishing the line, one of the landowners is bound to feel out of sorts and think the surveyor has favored the other. The establishment of section lines and quarter section lines or of any other farm line is really a difficult proposition, that is, when no monuments exist to mark the ends of such lines. When establishing a farm line, it should be the intention, speaking generally, to establish the line exactly where it was originally placed when the country was first sectionized. I work in a locality that was the first area west of the Allegheny Mountains to be divided into sections. In fact the Indiana-Ohio state line was the first principal meridian established. The work was crudely performed, the old open sight compass and the old type sixty-six foot chain being used. The country was full of shrubbery and undergrowth, the land was rough and broken in topography, the chain was, no doubt, allowed to become twisted and snarled around the undergrowth, and to follow these old surveys when no monuments exist is a very difficult matter.

STREET PAVING PROBLEMS

Any engineer following his profession in small cities or towns is well aware of the criticisms, objections, and condemnations that are usually heaped upon his head when any new improvement is in prospect. I have in mind a street paving job on which I was employed a few years ago in a small town. A petition was filed with the board of trustees of the town asking that a certain street, about a quarter of a mile in length, be paved. The board was favorable to the idea, and, after some discussion as to type, instructed me to make the necessary survey and prepare plans and specifications for a concrete pavement. The board holds regular sessions once a month, and at their next session I presented my work for their approval. I had used a section of pavement that is now generally used the country over, that is, the thickened edge type. After showing and explaining my plans, the chairman who dominated the entire board curtly inquired as to my reason for not designing a pavement like some built in this town twelve years before. On this older pavement we had used the 6-8-6 type. He stated that this had given good service and he saw no reason for changing. I politely informed the board that we had learned quite a bit since that time, that long and expensive tests had demonstrated the thickened edge type to be the better and that now it was almost the universal practice to use that type. More or less argument ensued and the upshot of the whole matter was that a motion was made and carried

wherein I ceased to represent the town as its engineer. The town's attorney stated to the board that if they employed another engineer they could likewise employ another attorney, and the session ended without the board's approval of the plans and without the appointment of another engineer. Some two or three days afterwards two of the members of the board who had concurred in my discharge came to me and asked that I forget what had previously occurred; and, with my consent, at the following session of the board I was reinstated, whereupon the chairman of the board resigned. No opposition to his resignation was voiced by the other members, though no action was taken to fill the place nor was the office declared vacant; and, after a time, this member, realizing that he was not receiving the sympathy which he expected and that his actions had been more or less foolish, again participated in their sessions. My plans were followed and the improvement was carried to successful conclusion.

Harmony, of course, between the engineer and the governing officials of any county, city or town by whom he is employed is very much to be desired. That such harmony does prevail is not in itself perfect assurance that any public undertaking will be brought to a successful conclusion without more or less grief along the way. I have in mind a job of street paving during the past year in the same little town previously referred to, and, by the way, this same gentleman who was chairman of the board during the episode previously mentioned was again chairman of the board of trustees, then serving his third or fourth term. The job in mind was a pavement job, something over a half mile in length and connecting an improved street with the north corporation line. It was a worthwhile project and no opposition was voiced by any taxpayer affected. When preparing the plans the most serious obstacle to overcome was the matter of drainage. No storm sewers existed, no well-defined water courses were available, and theretofore the water had been allowed to dispose of itself in any way it was of a mind to take; but, as a matter of fact, most of it just soaked into the ground, which was a sandy loam. About a quarter mile west of this street ran a fair-sized creek and I advised that we arrange the grade so that the storm waters could be carried to this creek through a sewer. This met with the approval of the board and we proceeded with the preliminaries. However, upon negotiating with the property owners for a sewer right-of-way, no amicable settlement could be reached and, as the board was averse to condemning. the matter was tabled. Abutting property owners continued to hammer at the board for action and, in more or less desperation, the board ordered me to arrange the grade so that the water would run both ways from the existing high point in the street. This meant that from a point about four hundred feet from the south end the water would flow south and

from this same point the water would run north. That part flowing south would be taken care of by an existing storm sewer, but that part flowing north for a distance of about a half mile, would empty into a rather deep ravine just outside the corporate limits.

This arrangement did not appeal to me, as I was decidedly in favor of condemning for a sewer right-of-way. The street contained a number of abutting residences, the yards were graded and in grass, residence walks were built, and by carrying the water through a sewer, I would be enabled to arrange the pavement grade so as to fit in properly with the work done around these residences, it being impossible to do this if the orders of the board were carried out. However, the board had been worried sufficiently; so I voiced no strenuous objection to carrying out their order and proceeded to follow their instructions and get out my work so that the improvement would proceed without further delay. Everything ran smoothly for a while; the work was advertised and a number of bids were received from responsible contractors. While the board was discussing the bids and before an award was made, an attorney arose and stated that he represented the owner of the land crossed by the ravine in which it was proposed to empty the storm water and that, if the board proceeded to follow out the improvement along the lines shown by the plans, he would bring court action to enjoin throwing any water onto the lands of his client. The town's attorney advised the board that, in his opinion, no court would grant such injunction and the board made a conditional award, hinging upon the outcome of this threatened suit. The result of the matter was that the case was brought into court and that the court sustained the landowner. There we were, just as far along as we were in the very beginning.

The board then felt inclined to drop the whole matter, but the property owners continued to insist that their desires be granted. I still advised that they follow out the sewer proposal, but they were decidedly opposed to that. Numerous sessions were held to consider ways and means of putting this across, which resulted in nothing except wrangles and more or less ill-feeling.

Just within the corporate limits and adjoining the landowner who had succeeded in stopping the improvement, there was a vacant tract of land of about fifteen acres, extending from the street proposed to be improved to the creek previously mentioned. The owners of this tract were three sisters, well up in years, two of whom lived in Boston and one in Cincinnati. Someone suggested that it might be possible to acquire this tract, and that, if so acquired, the tract could be made into a public park and also serve as an outlet for the storm waters off the street. The suggestion met with general favor. The board said that if the land could be purchased for

any amount within reason, they were willing to make the expenditure; and negotiations were immediately started with the owners. The outcome of the whole matter was that the tract was purchased for about one half of what it was really worth, we arranged matters so that all outflow would be over this acquired tract, the improvement was successfully carried out, old sores were healed, and everyone appears to be happy over the final solution.

SOME ROAD CONSTRUCTION DIFFICULTIES

Oftentimes there are occurrences in the engineer's work which at the time are aggravating, yet comical as well. A few years ago we were building a township macadam road, including a fill ten or twelve feet in height and a few hundred feet long. While setting the slope stakes for this fill, I noticed that the old German superintendent, who had been appointed by the county commissioners and who was present during the time of setting the stakes, appeared to be puzzled as to their meaning. I explained to him just what the stakes meant and thought he fully understood my explanation. Some two weeks later I was back on this job and the fill was up to its proper level, though it lacked about ten feet of having the proper width on top. I was frankly puzzled. I saw that the toe of the slope extended to the stakes and that the embankments appeared to have the correct slope, and I was at a loss to understand why this condition existed. When I talked with the contractor, I was informed that, shortly after I had left after setting the slope stakes, several neighboring farmers had met at this fill with the superintendent, noted how far apart the stakes were, decided that I was asking too much from the contractor, and had simply pulled up every stake and set it five feet nearer the center line. The contractor, either through ignorance or thinking he was saving himself the expense of moving quite a bit of dirt, had permitted this. As a matter of fact, the expense of widening the fill from the top was materially greater than if the fill had been brought up full width from the bottom.

On another township road which we were building a few years ago, I had more or less trouble with the superintendent whom the board of commissioners had appointed. The road was just an ordinary, crushed stone road, but I endeavored to impress upon the superintendent the importance of having the contractor make his fills and cuts to the full width, keeping the grades uniform and in proper alignment and otherwise following out the specifications. This superintendent had a mind and ideas of his own and his ideas did not altogether harmonize with mine or with the specifications. One morning when I arrived on the job, I noticed that he was boiling, and when I got out of my machine, he said, "Come over here, I want to show you something." I walked to where he was

standing and he said, "I thought you told me to keep everything true and in a straight line. Now, why don't you do that yourself?" I asked him to explain what he meant and, pointing to a row of slope stakes which I had placed the day before, he said, "Cast your eye over those stakes. Are they in a straight line?" Of course, I could do nothing but throw up my hands in disgust.

You have all, no doubt, had similar experiences; likewise, you have had charge of many projects which have run smoothly from start to finish. We all strive to get good work. If the work is of a public nature. we endeavor to work in harmony with the other public officials and with the contractor and, at the same time, try to get work done that will receive favorable comment from the general public. When we accomplish these things, we are usually rewarded with a feeling of self-satisfaction over a job well done.

CONSTRUCTION PRACTICES ON CITY STREETS

By S. W. Hodgin, City Civil Engineer, Richmond, Indiana

In presenting this paper on construction practices on city streets, it is not the thought that a treatise on such work will be offered, nor that the practices discussed necessarily will be the best, nor a sort of ne plus ultra in street work. My efforts will be directed solely toward explaining the practices that have been in effect in my own city of Richmond. Some of these practices have been followed for many years and have proved their worth, while others are new and experimental only.

Richmond is a city of 33,000 population, with about 88 miles of streets, divided as follows:

Asphalt, 5 miles; brick, 7 miles; concrete, 16 miles; bituminous macadam, 5 miles; waterbound macadam, 20 miles; gravel, 22 miles, and unimproved, 13 miles.

With the exception of the very heavy traffic in the nine state highway routes within the city, the traffic on the improved streets is very uniformly divided and moderately heavy. As to their condition, I believe our streets are above the average for cities of Richmond's class and show the result of economic maintenance and consistent construction programs.

Before 1891, practically all of the usable streets of the city were of untreated gravel. Beginning with that year, a street improvement program was started and has been carried out religiously ever since, until, at the present time, 85 per cent of all streets are paved.

The cost of such improvements is now assessed against the abutting property in accordance with the Barrett Law. Rich-